ABOUT THIS REPORT

This report was developed by the Federal-State Task Team (FSTT) of the Subcommittee on Integrated Management of Ocean Resources (SIMOR).

The FSTT report constitutes a review of **early work** by the Joint Subcommittee on Ocean Science and Technology (JSOST) to develop an Ocean Research Priorities Plan.

Since this report was drafted, the JSOST has published a **new planning document** to garner feedback for the development of a public review draft of the Ocean Research Priorities Plan (See: http://ocean.ceq.gov/about/sup_jsost_public_comment.html). As described on page 5 and 6 of the planning document, the FSTT and others "reviewed the initial description of the themes" and the JSOST has "incorporated their comments and suggestions in the current descriptions of the themes."

Therefore, in reviewing the planning document, commenters may see that the feedback of the Federal-State Task Team has already been reflected. However, the FSTT feels that the earlier commentary is still useful for cross-reference and examination as to whether the priorities and concerns of the coastal and ocean resource management community are adequately addressed in the planning document.

In cross-referencing the two documents, the following cross-walk of theme names may be useful:

FSTT Report Theme Name

JSOST Planning Document Theme Name

Natural Hazards

Ecosystem Health
Oceans and Climate
Human Health

Mitigating effects of natural hazards
Improving ecosystem health
The ocean's role in climate change and variability
Enhancing human health

Understanding... (cross-cut: Basic understanding of the ocean)
Marine Operations Promoting marine operations

Living and Non-Living Marine Resources

Quality of Life

Tromoting marine operations

Sustaining natural resources

Improving quality of life

Peyton Robertson, Federal-State Task Team Co-chair March 30, 2006

A Report on Ocean Research Science and Technology Priorities

of the

Coastal and Ocean Resource Management Community

Federal/State Task Team
of the
Subcommittee on Integrated Management of Ocean Resources

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EXECUTIVE SUMMARY

NOTE: A Federal/State Task Team of the Subcommittee on Integrated Management of Ocean Resources (SIMOR) was established to review and provide input on the U.S. Ocean Research Science and Technology Priorities Plan and Implementation Strategy being developed by the Joint Subcommittee on Ocean Science and Technology (JSOST). We conducted our review based on early versions of JSOST "two-pagers" that were further developed and refined to produce a "Draft 0" of the JSOST Ocean Research Priorities Plan. We provided the Executive Summary of this report, including the scorecard below, as our preliminary input on January 10, in advance of the JSOST "Draft 0" release on January 16, 2006. We acknowledge that some of the feedback contained in this report is reflected in "Draft 0" release of the JSOST Ocean Research Priorities Plan. However, the timing of this release was uncertain in the development of our report, therefore the completion of our work did not dovetail perfectly with the JSOST schedule. As a result, the bulk of our analysis was completed prior to the release of the JSOST "Draft 0" Plan, but we did not finalize our report until just after the release.

Given these circumstances, some of the comments in this report have already been addressed. Even so, the Federal/State Task Team feels that the more detailed analysis of research priorities of coastal and ocean resource managers based on the preliminary themes of JSOST remains highly relevant. Therefore, we are transmitting the entire report as commentary for consideration by JSOST as they develop the next draft of the Ocean Research Priorities Plan. In addition, the FSTT will draft comments on "Draft 0" and submit them through SIMOR, consistent with the review process outlined by JSOST.

Coastal and ocean resource managers from around the country agree that the new focus of ocean research must be on the comprehensive study of marine and coastal ecosystems, reflecting appropriate differences in priorities at various levels (community, local, regional, etc.). This focus should include a significant investment in enhancing understanding of the "human dimension" as a key component of and influence on these systems. The scope of this work must encompass not only the blue water ocean, but extend inland, from the coastal and estuarine brown water to the upstream limits of coastal watersheds.

Our review of the preliminary research priorities theme "two-pagers" was very encouraging. However, we have taken the liberty to identify gaps in the list of needs and highlight some differences in priorities for managers. We feel strongly that the U.S. Ocean Research Science and Technology Priorities Plan must address the critical need to create new, efficient and effective mechanisms to ensure that dividends from federal research investments accrue to resource managers responsible for protecting and managing our coasts and oceans.

A number of critical resource management research priorities were not sufficiently described or addressed by the themes and content of the JSOST draft two-pagers. The following table provides a cursory ranking of High, Medium and Low as to the clarity of the themes and topics outlined by the JSOST and the extent to which the two-pagers addressed coastal and ocean resource management research priorities, including Great Lakes issues. Details of the rationale behind these rankings follow, including gaps identified by the Federal/State Task Team (FSTT).

Federal/State Task Team "Scorecard" on JSOST Draft Two-pagers

JSOST Theme	Clarity of Theme/Title	Alignment with Identified Resource Management Priorities
Quality of Life*	Low	Low
Protecting Human Health	Medium	Low
Mitigating Natural Hazards	High	High
Living and Non-Living Resources	Medium	Medium
Ecosystem Health	High	High
Climate	Medium	Low
Marine Operations	Medium	Medium
Advancing Understanding	Low	Medium

^{*}The FSTT did not initially have a two-pager for this topic

Scorecard Key:

CLARITY:

High = The theme/title is clear and speaks for itself. It is recognizable as a key issue for coastal and ocean resource managers.

Medium = The theme/title is generally understood, but subject to some interpretation. It is less clear as to its implications for coastal and ocean resource management needs.

Low = The theme/title is difficult to interpret on face value. It is unclear as to its significance for resource managers as it may encompass a broad array of subjects.

ALIGNMENT:

High = The two-pager aligns very closely with the research needs identified by the FSTT. It includes considerable commonality of thinking and rationale.

Medium = The two-pager aligns generally with the research needs identified by the FSTT. It includes similar needs but may not address the full suite of resource management concerns.

Low = The two-pager does not align well with the research needs identified by the FSTT. There are significant gaps or other issues associated with the topic (e.g., poor fit)

Description of Scorecard Criteria as applied to each JSOST Theme:

Quality of Life

- CLARITY (Low): The theme is too broad and subjective for clear interpretation. As a social indicator, "quality of life" could be considered dependent on all of the other themes.
- ALIGNMENT (Low): Ostensibly focused on tourism, this theme could also reasonably include a wide range of factors critical to resource managers, including the quality of coastal development, availability of services, ecosystem stressors, etc.
 There is a need for research on methods to reliably predict the impact of population growth and land use on ecosystem services, function, and condition.

Protecting Human Health

- CLARITY (Medium): While relatively clear, this topic can be misinterpreted as what benefits can be gained from coastal and ocean research to human health or as what is necessary to protect human health from harmful effects and events in the marine environment.
- ALIGNMENT (Low): Of particular interest to resource managers and not fully addressed by the two-pager is the need for the development of tools for real-time or rapid assessment of microbial densities and their sources; and for adequate monitoring and assessment of anthropologically introduced microbial, chemical, and pharmaceutical agents.

Mitigating Natural Hazards

- CLARITY (High): This JSOST draft two-pager adequately characterizes the research necessary to understand and mitigate the impacts of coastal and ocean hazards.
- ALIGNMENT (High): While this theme is in good alignment with the priorities of resource managers, there is additional need for timely, accurate, and reliable information, integrated and synthesized into improved warning systems and models that forecast waves, currents and storm surge. Resource managers are, in general, poorly prepared to evaluate the threats of natural hazards, to understand long-term vulnerabilities, or to take actions with cost-effective, science-based response, mitigation and restoration strategies.

Living and Non-Living Resources

- CLARITY (Medium): Generally clear, but slightly confusing in terms of the differences in strategies for managing living and non-living resources and the interactions between them.
- ALIGNMENT (Medium): Relatively consistent with resource management priorities, but assessment of coastal land-use patterns and cumulative impacts are also current and priority needs for managers. Additional research is needed to improve the understanding of land-use patterns and demographic changes in coastal communities, and to investigate the cumulative impacts of multiple environmental stressors on a

variety of oceanic, marine, and estuarine living and non-living resources. It should be recognized that in the Great Lakes, freshwater itself is a resource.

Ecosystem Health

- CLARITY (High): This theme is relatively clear, but encompasses such a broad range of research needs that it could subsume other themes and topics. For example, separating "quality of life" from ecosystem health calls out the human dimension as a discrete theme in and of itself, while humans are clearly part of the ecosystem.
- ALIGNMENT (High): Very strong alignment exists between the JSOST ecosystem
 health discussion of research needs and the priorities of resource managers. Resource
 managers want a stronger focus on improving management practices and have critical
 need for socio-economic data. In addition, resource managers need baseline surveys
 of coastal and marine habitats and populations.

Climate

- CLARITY (Medium): The climate theme was not as clear as it should be. The terms "climate change" and "understanding the effects of climate on oceans" are used in current descriptions of this theme. The focus of this research theme should be clarified.
- ALIGNMENT (Low): There was generally poor alignment between the climate research focus of resource managers as compared to the JSOST two-pager. Resource managers need research on the impacts of climate change on coastal communities, as it influences sea level rise and hurricane frequency and severity. Similar focus is needed to examine the effect of climate change on estuarine and coastal habitats, including coastal marshes and wetlands.

Marine Operations

- CLARITY (Medium): This theme is unclear with respect to the focus of coastal and ocean research needs. For example, invasive species could be included here, but was found also under ecosystem health. If the emphasis is on the impacts of marine operations, perhaps that should be included in the title.
- ALIGNMENT (Medium): Resource managers have identified a need for methods to cost-effectively: (1) respond to marine operations-related events (such as spills, search and rescue, and noise) and; (2) restore marine ecosystems impacted by such events. Additionally, managers want operational real-time fields and forecasts of wind, waves and near-surface currents that drive spill motion near shore and at sea.

Advancing Understanding

- CLARITY (Low): This topic was not clear and different in context than the rest. The Federal/State Task Team came to interpret this theme as "basic research."
- ALIGNMENT (Medium): A priority issue that carries across all of the JSOST themes is a need to transfer of findings of research, from basic through applied, to resource managers, particularly understanding natural versus anthropogenic forcing

functions and the timely translation of research discoveries, insights, capabilities and techniques to operations and management.

The summary information provided above is a snapshot of the findings of the Federal/State Task Team based on preliminary work of the JSOST. The compilation of research needs assessment information on which our review is based came from *existing* sources, not new polling or inquiry. Additional details, including common themes, geographic differences, and gaps, are included in the full report that follows.

As a sub-unit of the Subcommittee on Integrated Management of Ocean Resources, the Federal/State Task Team reflects the feedback of the resource management community, focused on ensuring the translation of science to management. The Federal/State Team found a recurrent need to make the connection between social science and environmental research. We commend the working relationship between SIMOR and JSOST as a means to ensure communication in both directions – articulating the needs of resource managers for science and translating the results of research to inform new approaches for management.

BACKGROUND

Under the auspices of the Subcommittee on Integrated Management of Ocean Resources (SIMOR), a Federal/State Task Team was established to provide input from federal and state coastal and ocean resource managers to the Joint Subcommittee on Ocean Science and Technology (JSOST) in the development of the U.S. Ocean Research Science and Technology Priorities Plan and Implementation Strategy. SIMOR and JSOST are part of the new, coordinated governance structure established by the President's U.S. Ocean Action Plan, which calls for an implementation strategy that will "identify how the various ocean science sectors (government, academic, industry and other nongovernment entities) can and should be engaged, individually or through partnerships."

The Federal/State Task Team (Task Team) serves to ensure that resource management needs are incorporated into the design, recommendations, and implementation of the new strategy. Task Team membership includes state representatives from coastal regions, estuarine research reserves, Sea Grant, and fisheries, wetland, and floodplain management agencies along with federal representatives with particular expertise in coastal and ocean science and research needs. A list of the Federal/State Task Team members is included as Appendix A.

The Task Team got underway in September 2005. The Task Team divided its work into two key areas:

- 1. Review of initial "two-pagers" drafted by JSOST for a series of eight research themes:
 - Quality of Life
 - Protecting Human Health
 - Mitigating Natural Hazards
 - Living and Non-Living Resources
 - Ecosystem Health
 - The Ocean and Its Role in the Climate System
 - Marine Operations
 - Advancing Understanding
- 2. Collection, binning, and summarizing of research priorities gathered from existing information sources generated by the coastal and ocean resource management community to identify:
 - high priority coastal and ocean research needs
 - specific problem areas
 - immediate needs for addressing resource management challenges

During a period of just three months, the Task Team conducted over a dozen conference calls and made contact with numerous resource management entities to capture national and regional research priorities. The Task Team identified many recent and ongoing

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efforts to prioritize research needs among the coastal and ocean resource management community. The compiled information from these efforts is available from the Task Team; a list of the 75 sources, which identifies the documents and formal and informal needs assessments cited, can be found in Appendix B.

Given the extremely short time frame for its work and limitations on the size and composition of its membership, the Task Team acknowledges that there are topics, groups, and geographies not fully represented in this report. However, particularly with respect to the national perspective, the research priorities of the coastal and ocean resource management community have consistent themes and commonality. The Task Team expects that additional ongoing efforts, such as those in the southeast and Gulf of Mexico, will provide more clarity on specific regional research needs. This finer resolution should be considered even more closely as the JSOST moves from its Priorities Plan to its Implementation Plan.

OCEAN RESEARCH SCIENCE AND TECHNOLOGY PRIORITIES

Natural Hazards

Context

This synopsis of research priorities relating to "storms, floods, earthquakes, tsunami, volcanoes" (per the identified JSOST topics for Natural Hazards) is based, in part, on a compilation of national and regional information needs. General or "national" needs included 21 bulleted items; the remaining two-pages dealt with the Pacific Coast (15 bullets), Northeast (6), Great Lakes (3), Alaska (1), and Caribbean (1). The Hawaiian and Pacific Islands, Gulf of Mexico, and southeast regions were not represented in the original three-page compilation. To partially overcome these geographical biases, one additional information source was used, a USGS (2004) report titled "A Plan for a Comprehensive National Coastal Program."

Brief Summary

Resource managers recognize that coastal communities and landscapes are variably atrisk to potentially devastating effects of earthquakes, volcanoes, storms and associated landslides, tsunamis, flooding, and debris flows. Hurricanes Katrina and Rita and the December 2004 Indonesian earthquake and resulting tsunami are vivid, recent examples of the enormous influence that natural hazards pose to fundamental physical, ecological, social, and economic structures of coastal environments. The compilation suggested that resource managers are concerned about our current inability to anticipate extreme natural events. We lack effective early warning systems and evacuation protocols to protect coastal residents. We lack knowledge of disasters' relative risks. We lack adequate tools and techniques to monitor and forecast wave and current conditions. Key, relevant information to aid decision-making is either not available or has not been disseminated effectively. Social and economic data have not been meaningfully integrated with valuation data on ecosystem services and functions. Some managers seek more information about the potentially compounding effects of sea- and lake-level change/subsidence as related to natural or anthropogenic factors, including climate change. Hence, resource managers are, in general, poorly prepared to evaluate the threats of natural hazards, to understand long-term vulnerabilities, or to take actions with costeffective, science-based response, mitigation and restoration strategies.

Common Themes

- Development and deployment of new ocean sensors, tools, and enhanced techniques for broad-scale data acquisition, data delivery, and integration.
- Timely, accurate, and reliable monitoring information, integrated and synthesized into improved warning systems and models that forecast waves, currents, and storm surge.
- Shoreline protection, shoreline change, and related topics dealing with erosion, sediment dynamics, sand budgets, and sand resources.

- Maps and models of coastal hazard zones, inundation patterns, flooding potential, wetland loss, subsidence, sea- and lake-level changes under different event scenarios – including climate change.
- Assessments of risks and vulnerabilities, including cost/benefit analyses as applied to improving or retrofitting buildings, port infrastructure, strengthening building codes, and better managing land use.
- Fundamental process studies of physical, hydrological, chemical, and ecological responses to severe or extreme events.
- Evaluation of past events and impacts from geological records.
- Recovery and restoration strategies with measures of their effectiveness.
- Information management and dissemination, including access to accurate, highresolution maps, images, and improved visualization techniques.

Geographic Differences

Given the unequal treatment of the regional needs assessments, any apparent geographic differences in the short lists must be evaluated with caution. Threats, however, do vary. Based on the USGS (2004) report, suffice to say that for the Pacific (Alaska, northwest, California, Hawaiian and Pacific Islands) primary concerns include earthquakes, tsunamis and resulting landslides and erosion. Primary threats for the Gulf Coast, Caribbean, and southeast include hurricanes, sea-level rise, subsidence, and wetland loss. Northeasterners risk storms, sea-level rise, and erosion. The Great Lakes region is largely spared from earthquakes, tsunamis, and volcanoes, but severe storms do occur and changing lake-levels and erosion are threats.

Gaps in this Topic and Alignment with Resource Management Priorities

Based on this limited compilation of research needs, the resource management priorities are generally aligned with the preliminary JSOST assessment. One noteworthy difference is the mention of "offshore wind and wave damage," referring, for example, to impacts to offshore oil and gas infrastructure – a topic not found in our compilation.

Closing Commentary

The preliminary JSOST vision and justification statements offer an appropriate summation to our short synthesis. It calls for a "persistent and coordinated investment in research and technology...that will lead to reduced exposure, lives and property saved, and more rapid recovery through strategic policies and planning, effective mitigation, and an informed and effective response."

Significant U.S. coastal and marine hazards are identified by JSOST as including:

- Severe storms and hurricanes and associated coastal and offshore wind and wave damage;
- Coastal inundation and flooding from storms, tsunamis, and regional meteorological events;
- Earthquakes, landslides, and slope failures along the coast and offshore and resulting tsunamis.

Ecosystem Health

Context

In the JSOST theme description, ecosystem health focuses on coastal and marine ecosystem processes, interactions, and linkages. Research is needed to better describe, understand, and predict marine ecosystem structure and function, thereby facilitating both marine ecosystem conservation and management. This is achieved through linking physical, chemical, biological, and ecological aspects of the ecosystem, including interactions among earth, atmosphere, and oceans that support marine ecosystems. This theme also covers the need to assess human impacts and to accurately determine the value of ecological goods and services provided by coastal and marine ecosystems.

Brief Summary

The Ecosystem Health theme included 17 pages of research priorities. This theme, along with the Resources theme, constituted the bulk of the research priorities compiled from around the nation. While there is overlap among all of the themes, these two are the most directly related because they focus on the need to better understand and maintain the ecosystem goods and services upon which humans rely. Additionally, these priorities are derived primarily from resource managers, who by definition focus on coastal and marine resource issues. Currently there is momentum for taking an ecosystem-based approach to managing resources. This forms the backbone of the Ecosystem Health theme which is based on understanding linkages within ecosystems, including human linkages.

The following cross-cutting priorities capture the major principles of this theme:

- Establish a principled, unified national ocean policy based on protecting
 ecosystem health and requiring sustainable use of ocean resources including an
 ocean research strategy that will guide agency science plans for at least 10 years.
- Study relationships among habitat structure and function, sediment processes, nutrient dynamics, population and community development, restoration techniques and performance criteria, and economic and ecological valuation.
- Assess the impact of multiple stressors on a variety of scales by linking both short-term and long-term observations with experimental and theoretical studies.
- Protect important habitat and manage coastal development to minimize habitat damage and water quality impairment.

Common themes

The research priorities were binned into the six broad categories below.

- A. <u>Transport, Fate, and Impact of Pollutants, Eutrophication, Sediments, and Nutrient Cycling</u>
- More study on inputs and resulting conditions including nutrients, hypoxia, harmful algal blooms, pathogens, runoff, storm water, aerial deposition, emerging

- contaminants, non-point source, mercury, waste water, groundwater, and contaminated sediments.
- Better understanding of the sources, transport, fate, effects, cycling, environmental responses, accumulation, and chemical processes of pollutants, sediments, and nutrients.
- More research on management strategies, including forecasts, rapid indicators, source-specific indicators, risk assessments, control, treatment, tradable credits, reduction, remediation through wetlands, modeling, and monitoring.

B. Assessing and Restoring Ecosystem Services, Structure, Function, and Linkages

- Ecosystem components in need of study include airsheds, watersheds, wetlands, riparian corridors, estuaries, nearshore, and offshore.
- Critical topics of investigations include: anthropogenic impacts, ecosystem recovery and resilience, physical and biological processes, change in ecosystems, population dynamics, large-scale relationships, indicator species, food web relationships, landscape pattern, water quality, coastal land uses, and ecosystem structure and function.
- The key methods include: habitat mapping, rapid ecological assessment, longterm monitoring and observing, analysis of metadata, baseline information, information management and forecasting, ecosystem models, and demographic parameters.

C. Management

- Management systems in need of more study include: marine protected areas, total maximum daily loads, habitat restoration, mitigation, and remediation.
- Management approaches in need of further development include: adaptive
 management, science-based management, ecosystem-based management, best
 management practices, economic and environmental indicators, monitoring,
 decision support and assessment tools, cost benefit and comparative analyses,
 sustainability criteria, modeling, and ocean observing.
- Management effectiveness can be improved via: coordination of data collection, collaboration, data synthesis and dissemination, technology, data management, translation, and public education.

D. Land and Water Use

Studies are needed in nearshore habitats, estuaries, and watersheds in the
following areas: habitat change, indicators, ecosystem impacts, water withdrawals
and discharges, coastal development, climate change, freshwater inflow, water
budgets, and interactions between surface water, groundwater, and the
atmosphere.

E. Invasive species

• Research is needed to prevent new introductions, and identify, control, and eradicate established invasive species.

 In particular, studies on the factors and conditions that influence the probability of invasion are needed.

F. Socio-economics

 The priority research topics for socio-economics include: economic valuation, human dimensions, coastal communities, coastal-dependent industries, and local/traditional knowledge.

Geographic Differences

The majority of the research priorities came from the Pacific coast and east coast regions, including: Alaska, Pacific Northwest, California, Great Lakes, Gulf of Maine, and the Mid Atlantic. The following regions: South Atlantic, Florida and Caribbean, Northern Gulf of Mexico, and Hawaii and Pacific Islands were poorly represented. Only general research priorities were available for these regions from a 2004 Coastal States Organization report. This report stated that land use and habitat change are the two topranked management topics for these regions. It is important to note that although some regions may not be well represented, their priorities may still be captured in this summary. It is beyond the scope of this summary to assess the top priorities for each region, therefore, the summary of research priorities is focused on national needs that encompass all of the individual regional priorities.

Gaps in this Topic and Alignment with Resource Management Priorities

There were few differences among the scope of the topics described by JSOST and what was presented in these research priorities. In general, both covered: linkages within ecosystems; assessing the status of and monitoring the dynamics of ecosystems; implementing adaptive strategies for ecosystem restoration and conservation; establishing measures of success; developing monitoring infrastructure, and developing partnerships and increasing collaboration among stakeholders.

The JSOST summary was slightly broader in scope because it included all aspects of marine ecosystems. In contrast, the majority of the ecosystem health resource management research priorities focused on the land-sea interface and human impacts on sensitive coastal habitats. The research priorities presented here have a stronger focus on improving management practices and providing socio-economic data. While detailed here, invasive species were not specifically mentioned in the JSOST summary. However, the priorities in the JSOST summary are broad enough to address this issue.

Closing Commentary

Achieving the goal of a sustainable global ocean ecosystem is fraught with many challenges. For example, implementing ecosystem-based management is extremely complex and resource intensive, requiring the investment of large quantities of time, money, expertise, and cooperation. Yet achieving this goal is critical to human health and welfare.

Oceans and Climate

Context

Issues under the Climate theme include short and long-term climate changes and variability, and climate change impacts. Although specific "climate research" was one of the least-noted needs among the resource managers nationally, issues related to global change (including sea level changes, changes in coastal vulnerabilities to storms, etc.) were among the most highly ranked concerns of coastal and ocean resource managers.

Brief Summary

A strong theme throughout this topic is the need to understand interrelationships among land use, climate, freshwater flow, submerged and emergent habitats (coral reefs, seagrasses, the intertidal and marshes) and nutrient and pollutant loading; and to understand the effects of changing climate on these interrelationships. Resource managers are often responsible for planning response strategies to address the vulnerability of coastal habitats and human communities to storms, and therefore require information about probable rates of sea level change and trends and variability in climate conditions.

The impact of climate change on coastal marshes (including their function in carbon sequestration processes), changes in winter ice cover in the Great Lakes, ocean salinity, and changes in fisheries and fisheries management were also noted by regional resource managers. In Alaska, effects of long-term climate change on marine mammals and fisheries; climate variability impacts on humans and subsistence harvesters; and baseline assessment issues were noted research needs of resource managers.

Resource managers also noted the need for new and enhanced assessment techniques to evaluate changes in the coastal areas resulting from climate change, including LIDAR and visualization tools to develop vulnerability assessments for coastal areas and to predict shoreline change, sea level rise and loss of wetlands. Ocean monitoring to monitor changes in ocean characteristics, including changes in sea ice cover and marine life, was also noted as a need.

Common Themes

- The response of coastal landforms and ecosystems to climate change and sea level rise
- Interrelationships among land use, climate change, freshwater flow, and nutrient and pollutant loading.
- Effects of climate change on estuarine and coastal resources, including the effects of rising sea level on coastal marshes and predictions for different scenarios and different regions

Geographic Differences

Great Lakes

- Floods, droughts, losses or reductions of winter ice cover, and other extreme hydrologic responses to changing climate
- Effects in the coastal zone from lake level changes due to natural variability and human intervention

Alaska

- Monitor climate change effects on fisheries and subsistence. Monitor temperature increases in Alaska's waters, understand the likely effects on fisheries resources.
- Evaluate and predict future impacts of climate change to change management and harvest programs accordingly.
- Understand subsistence households' harvest levels and distribution networks, understand household subsistence production in subsistence-dependent communities across years, enhance opportunities to harvest subsistence resources in subsistence-dependent communities.

Gaps in this Topic and Alignment with Resource Management Priorities

The vision of the Oceans and Climate JSOST summary (fall edition) is stated as follows. "In the past century it was demonstrated that the ocean plays a fundamental role in governing the climate through its large storage capacity for heat, water, and greenhouse gases. In the 21st century, the challenge is to better understand the ocean's role in climate in order to increase predictability of the climate. The ability to monitor ocean budgets for heat, water, carbon and nutrients will improve society's ability to respond to natural hazards and climate variability and prevent loss of life and property. There is also a growing body of knowledge about the impact of climate on marine chemistry and ecosystems will facilitate ecosystem-based management of the oceans."

Perhaps not surprisingly, resource managers have identified quite different priority needs for oceans and climate than is stated in the JSOST vision. Specifically, the forecasted effects of climate change on coastal communities (natural and anthropogenic) and how best to develop strategies to address these changes are of primary importance to resource managers, and does not appear to be as critical as is basic ocean/atmospheric heat and energy budget research to the JSOST team. As is a theme across several of the JSOST fall edition papers, the implementation focus appears to be primarily on the Ocean Observing System.

Closing Commentary

The need for better understanding and prediction of effects of climate variability and change is highly ranked among resource managers, particularly impacts of changing sea level and storm frequency and strength. Although heat, carbon and nutrient budgets for the ocean are important components necessary to address oceans and climate, applying results to more fully understand resulting climate change and variability on coastal and ocean resources are equally, if not more, important to address resource management priorities.

Human Health

Context

The JSOST summary of this topic focuses on two themes. The first is the lack of knowledge of and untapped resources in the world's oceans that could effect and be affected by human activities. The second theme addresses the risk to human health associated with human consumption of seafood and from direct and indirect contact with the oceans. Consequently, resource manager research priorities related to seafood, Harmful Algal Blooms, and natural and anthropogenic pathogen pathways were included.

Brief Summary

This issue area included six pages of individual research priorities, making it one of the least noted areas of research interest to managers. However, the following major themes were consistently identified:

- Real-time or rapid assessment of microbial densities and their sources;
- Detection of pathogens, contaminants and toxins in seafood;
- Improved understanding of the linkages between the causes, both natural and anthropogenic, of pollution and toxic effects, like HABs, and the effects of those ecosystem conditions on human health.

Resources managers are keenly interested in the prediction of the incidence and effects of contaminants, pathogens and pharmaceuticals on human health. Managers also identified the need for methods to improve processing and storage of seafood to both protect human health and make more seafood broadly available.

Common themes

- Rapid bacterial contaminant level quantification and source identification.
- Understanding the occurrence, effects of, and pathways to and through the ecosystem of persistent chemical contaminants in water, sediments, and wildlife and associated effects on humans.
- Toxics, especially mercury, in the seafood supply, were a recurring issue of concern.
- Evaluation of the health risks from swimming and consumption of seafood as well as the options for reducing the pollution/contamination sources.

Geographic Differences

The only significant differences of note were some of those identified by Alaska and reflect the unique circumstances of that area. They included the following:

- Changes in access or activities of subsistence resources and users, and their impact on local cultures; effects of climate change on subsistence resources and communities
- Cost effective spill prevention, response and contamination remediation techniques

- Protection of freshwater resources and identification of pollutants of critical concern to those resources.
- Effecting reduction in diesel air pollution by encouraging power generation using wind and use of wind-diesel hybrids.
- Evaluation of human health trends that will inform future decisions on the development of sanitation infrastructure. Determine effective domestic waste treatment that protects water quality in a cost effective manner, especially in Arctic climates.
- Methodologies for monitoring underground nuclear tests for future leakage.

In the Great Lakes region where the Lakes are a major source of freshwater for domestic use, the protection of water itself as a resource is critical. Research regarding the fate of toxic pollutants, control of pathogens, and means to address homeland security issues are all relevant to human health concerns.

Gaps in this Topic and Alignment with Resource Management Priorities

The JSOST discussion of this topic area was focused on broad, national-level issues and highlighted (1) the need for basic research and discovery of new information, and (2) the need for a national coordinating system to make better use of available data and research efforts. While most of the resource management priorities are more specific, they could be included in the broad national priorities that are identified.

The JSOST topic does not address some critical technological needs of managers such as rapid quantification of bacterial contamination, and the need for models and predictive capabilities. Additionally, some of the priorities identified for Alaska such as understanding subsistence communities and their ecosystem links, as well as researching sanitation infrastructure, are not included in the JSOST priorities.

The managers did not identify the need for biochemical and biotechnological research in the ocean to promote drug discovery and development, illness reporting and epidemiological knowledge of seafood caused human illnesses, or the associated need for a national database.

Closing Commentary

Resource managers' priorities focus on current needs for understanding, technology and tools to improve management responses to problems associated with human activities, the environment and human health. The JSOST looks forward and addresses more basic research needs and broader national networking and database issues. What is unique from the resource management perspective is the call for attention to current, real problems through applied research.

Understanding the Ocean Environment and Its Role in the Earth System

Context

This topic area includes the need for basic research to understand the natural processes that drive variability and change in the coastal and ocean environment, as well as understand how the ocean environment responds to both natural and human-induced changes, current and future. Furthermore, there is a need for improved understanding of the ocean's role in the Earth system, particularly in the context of global climate. This is a cross-cutting theme that provides overarching context and linkages across all of the other JSOST priority topic areas.

Brief Summary

Several unifying themes emerged from the binned analysis of resource management priorities for this topic area; these are generally consistent with the JSOST summary. First, there is a need to understand the inherent natural climate (interannual to decadal) and event-scale variability in the ocean environment, with a particular focus on coastal ecosystems given their ecological and socio-economic importance. Additionally, there is a compelling need to better understand anthropogenic forcing and its impacts on global, regional, and local scales and in turn distinguish natural from human-induced changes. Both these issues need to be addressed in an interdisciplinary context, with a compelling need to more effectively couple physical, biological, biogeochemical, ecological and socio-economic parameters, approaches and perspectives within the ocean environment as well as across the terrestrial-aquatic-atmospheric domains. This will enable greater predictive capabilities and improved ecosystem and resource management, particularly in valuable and/or vulnerable coastal regions.

Finally, in support of this general need for improved understanding, there is a need to develop and deploy new, improved and integrated observational capabilities (remote and in situ), as well as facilitate the transfer of research discoveries, insights, capabilities and techniques to resource managers. In this context there is a continuing need to foster the transition from data to information to knowledge, including the need for derived data products and data fusion, enhancements in global and regional modeling and data assimilation capabilities, and more timely, accurate and effective information delivery to resource managers and other end-users. Given the increasing importance of coastal regions, these capabilities need to effectively target and resolve both sides of the land-sea interface, and not just focus exclusively on the ocean environment.

Common Themes

Some of the primary overarching research themes and observational priorities identified as part of this effort include:

- Characterizing climate and event-scale variability in coastal systems, understanding natural and anthropogenic forcing, and assessing and forecasting change;
- Generating climate quality data records and developing techniques to detect and forecast climate and ecosystem (regime) changes that (might) occur in ocean

basins over time-spans ranging from years to decades, and examining how these changes affect the various trophic levels in the marine food web;

- Deriving more ecosystem relevant information from existing satellite data sets;
- Developing, deploying and maintaining improved *in situ* and remote sensing sampling assets and networks, particularly to provide greater spatial, temporal and spectral resolution of ocean and coastal regions for both existing and novel measurements, and also supporting adaptive, coordinated remote and *in situ* sampling;
- Generating standardized, seamless, and easily accessible maps incorporating living and nonliving marine resource and socio-economic data with various physical attributes (e.g., bathymetry/topography) throughout coastal regions;
- Creating new and/or improved integrated models, data fusion and assimilation capabilities, and information management, delivery and analysis tools and techniques to meet user information needs;
- Facilitating the timely transfer of research discoveries, insights, capabilities and techniques to operations and resource managers.

Geographic Differences

Some of the distinct *regional* research themes and observational priorities identified as part of this effort include:

- Studying the effects of (El Niño Southern Oscillation (ENSO) events, Pacific Decadal Oscillations (PDO), large-scale regime shifts, and climate change within the California Current system on variable time scales;
- Understanding extreme environments, e.g., the deep sea off the Pacific Northwest;
- Susceptibility of the Gulfs of Maine and Mexico and other near shore coastal bays to dissolved oxygen depletion;
- Evaluating and predicting future impacts of climate change on Alaskan fisheries.

Gaps in this Topic and Alignment with Resource Management Priorities

Given the general nature (by necessity) of the JSOST summary for this topic area, most of the research themes and observation priorities identified are within the broad scope articulated by the JSOST document. Some of the priorities that have emerged here are quite detailed and specific, however, and as such can provide a way forward beyond a more general needs assessment.

Closing Commentary

The JSOST summary identifies compelling needs and general directions for improved understanding of the ocean environment and its role in the Earth system. These insights reflect to a considerable extent how resource managers already undertake their diverse responsibilities, i.e., considering the ocean and its various constituents as an integrated system, and *not* from a disciplinary physical or biological scientific perspective, and likewise seeing the ocean as inextricably linked with the terrestrial and atmospheric, as well as anthropogenic, domains to better understand relevant drivers, pressures, impacts, and responses. In this context, basic ocean research with its attendant observing priorities needs to continue evolving towards a more integrated, systems-oriented approach to

better serve the information needs of both scientists and resource managers. Improved communication, as well as transfer of technology and capabilities, is required between researchers and resource managers to spur development and maintenance of synergistic, efficient and cost-effective integrated ocean observing systems that can support the data and information needs of both communities in terms of timeliness, accuracy, and utility. Basic ocean research should also continue to address high priority science questions and issues that have no immediate or obvious resource management applications, thereby continuing to ensure novel discoveries which will also provide significant, albeit unforeseen, societal benefits.

Marine Operations

Context

Primary issues addressed under Marine Operations are navigation safety, homeland security (particularly in ports), comprehensive mapping and charting open ocean and coastal areas, the effects of dredging and dredged material management, environmental forecasting for navigation, security risks, inspections, marine sound, and pollution from ships, including introduction of invasive species.

Brief summary

Although issues under Marine Operations were not cited by resource managers as frequently as those in other areas, several priorities are evident. Resource managers priority research needs include effective control methods for reducing introduction of invasive species from ship vessel discharges; evaluation of the effect of noise generated by marine operations on marine communities; accessible and more rapid spill trajectory tools (oil and other contaminants); and assessment of risks of contaminants in dredged material and methods for identifying disposal options. Effective restoration techniques for ecosystems damaged by hazardous material spills and more effective spill prevention measures were also noted needs.

Strongest themes

Common themes identified by resource managers included:

- Identify control techniques for vessel sources of invasive species and characterize the waterbody conditions in which invasive aquatic species are likely to be successfully established;
- Evaluate the impact of noise generated by boating activity, seismic surveys, sonar, fish finders, depth finders, drilling for oil and gas, and military activities on marine mammals and other fauna:
- Provide operational real-time fields and forecasts of wind, waves and near-surface currents that drive spill motion at sea;
- Complete development of a comprehensive Digital Oceans and Coasts database for use in decisions on pipeline routes and platform locations, improved navigational safety and decreased environmental impact from marine operations;
- Assess the risk of contaminants in dredged materials and identify environmentally safe and beneficial disposal options;
- Develop integrated oil and other hazardous material spill trajectory and decision support models to improve prevention and recovery;
- Develop cost-effective methods and techniques for spill prevention, response and contaminated site cleanups that protect human health and the environment.

Other marine operations research needs identified by resource managers include evaluation of the impact of ship air emissions and deposition on coastal and estuarine waters; a better understanding of how contaminated sediment is created and transported; safer dredging or onsite treatment, and more effective post-recovery treatment of contaminated dredged material.

Geographic Differences

Research needs were generally consistent across geographic areas, particularly models and observation data for oil spill prediction; impact, response, and control of invasive species introductions from vessel discharges. Alaska identified additional needs for marine observations including sea ice and impacts of marine operations on artic and subartic fauna. In the Great Lakes, aquatic ecosystems have been significantly impacted by historical changes made to support commercial navigation (e.g. establishment of canals and channels in the St. Lawrence Seaway, operation of various locks and lake level controls.) Navigational activities have both directly altered aquatic habitat and indirectly impacted fisheries and aquatic ecosystems through introduction of invasive species. Additional research is needed to fully assess both past and proposed future changes.

Gaps in this Topic and Alignment with Resource Management Priorities

Resource manager needs and the initial JSOST summary were moderately aligned, particularly for understanding and controlling invasive species introduction from ship ballast; impacts from dredging and dredged material disposal; rapid spill trajectory tools; and the effect of marine operations noise on marine organisms. Manager issues which were not identified in the initial JSOST summary focused on cost-effective methods and techniques for response to marine operations-related events (such as spills and noise) and cost-effective techniques for clean-up and restoration of marine ecosystems from spills.

Closing Commentary

As with other issues, marine operations research needs identified by the managers were equally focused on evaluating restoration techniques and developing observing and forecasting tools and techniques.

Living and Non-living Marine Resources

Context

The JSOST issue paper on Resources focuses on the broad research needs to address conservation, understanding, and improved management of the coastal and marine resources that Americans value and use to generate wealth and enjoyment. These resources include harvests of fish and shellfish, extraction of minerals, development of pharmaceuticals, energy production, maritime transportation, and coastal tourism and recreation. In addition, new research is also needed to address the numerous ecological goods and services provided by the oceans and coasts such as flood protection, water quality improvements, biotic production, carbon sequestration, nitrogen fixation, and neutralization of toxins. Increased knowledge of human impacts on the coastal and marine environment, and improved understanding of the ways in which land and ocean resource use, pollution, and invasive species interact with climate variability and change, are prerequisites to sustainable management of the ocean's renewable and non-renewable resources.

Brief Summary

The Task Team review of research needs to address marine and coastal resource issues encompassed 27 pages and 374 bulleted topics for research that were drawn from reviews of 11 programmatic summaries. As such, the resources theme constituted the largest group of recommendations compiled from throughout the nation's natural resource agencies and coastal management programs. The majority of Task Team recommendations were concerned with assessment of the human impacts on marine resources and the need to develop techniques and tools that will allow for sustained management of habitats, populations, fishery species, and extractive resources. The Task Team review identified six common areas for new research: (A) Baseline Surveys of Marine Habitats and Populations; (B) Sustainable Fisheries and Marine Aquaculture; (C) Land-Use Patterns, Demographic Change and Trend Analysis; (D) Cumulative Impacts of Multiple Environmental Stressors; (E) Ecological Interactions and Natural Variability, and (F) Infrastructure for Science, Management, and Policy. These common research areas exhibit considerable overlap with the JSOST-identified Ecosystem Health research areas.

Common Themes

The Task Team research priorities within the Resources Theme were binned into six broad categories.

A. Baseline Surveys of Marine Habitats and Populations

- Habitat inventories, alteration, and loss
- Identification of critical habitat areas
- Biodiversity assessments and non-indigenous species
- Improved remote sensing imagery and analysis
- Nutrient dynamics in estuaries and nearshore waters
- Marine bioproducts and pharmaceuticals

- Exploration of poorly studied and novel marine habitats
- Characterization of offshore marine mineral and gas resources

B. Sustainable Fisheries and Marine Aquaculture

- Stock status, harvests, and trends for multiple fishery species
- Evaluation of alternative fishery management practices
- Development of fishery management models
- Bioaccumulation of toxins in fishery species
- Identification of fishery habitats
- Design and effectiveness of Marine Protected Areas
- Technology development for sustainable mariculture
- Evaluation and control of fishery and aquaculture diseases

C. Land-Use Patterns, Demographic Change and Trend Analysis

- Improved remote sensing imagery and analysis
- Development of habitat conservation strategies
- Habitat restoration, remediation, and enhancement
- Sediment supplies, beach erosion, and nourishment
- Development of GIS decision support tools

D. <u>Cumulative Impacts of Multiple Environmental Stressors</u>

- Urbanization and coastal development
- Commercial fishing
- Ecotourism/recreation and recreational harvests
- Energy extraction and water use
- Pollution, chemical contamination, and marine debris
- Invasive species
- Excessive nutrients, eutrophication, and hypoxia
- Pathogens and marine diseases
- Harmful algal blooms
- Development of best management practices

E. Ecological Interactions and Natural Variability

- Global, regional, and local climate change
- Coastal hazards and extreme events
- Regional and local hydrodynamic circulation and discharge
- Sustainability of marine ecosystems
- Ecological indicators of marine habitat conditions
- Ecosystem characterization, landscape models and forecasts
- Links between coastal areas, watersheds, estuaries, and ocean

F. Infrastructure for Science, Management, and Policy

- Comprehensive ocean resources monitoring and research plan
- Development of molecular biosensors and acoustic survey techniques

- Long-term monitoring and Integrated Ocean Observing Systems
- Socioeconomic framework for a marine ecosystem-based management approach
- Increased literacy about marine and coastal issues

Geographic Differences

All six of the common research needs identified by this review are shared as priority issues among the following regions: Pacific Northwest, California, Hawai'i and Pacific Islands; Great Lakes; and the Gulf of Maine. Identification of land-use patterns and development of the infrastructure for marine science, management, and policy were not highlighted as priority research needs for Alaska. Although most of the common research needs were identified as priority issues for the Gulf of Mexico, the GOM region did not highlight improved understanding of ecological interactions and natural variability as a priority research issue for marine resources. The Mid Atlantic and South Atlantic regions placed a high priority on baseline surveys of marine habitats and populations; sustainable fisheries and marine aquaculture; and assessment of the cumulative effects of multiple environmental stressors. The south Atlantic region also identified improved understanding of ecological interactions and natural variability, and development of the infrastructure for marine science, management, and policy as priority research issues for marine resources. In the Great Lakes, freshwater itself is a valuable resource. For example, the Great Lakes contain over 90 percent of the freshwater in the United States. Long term management of this resource requires additional research on pathways and long term fate of contaminants, the effectiveness of pollution reduction methods and programs, the relationship between diversion of surface and groundwater from the basin, and the long-term integrity of water supplies.

Gaps in this Topic and Alignment with Resource Management Priorities

The Task Team recommendations serve to identify two significant gaps in the list of JSOST priorities for research within the Marine Resources theme. These gaps are the Task Team common themes: (C) assessments of land-use patterns, demographic change, and trend analysis, and (D) cumulative impacts of multiple environmental stressors.

Closing Commentary

The list of marine resource research needs articulated by the U.S. coastal and ocean management programs provides a very broad, multi-disciplinary, and integrative set of issues and priorities for future research. The range of issues and research needs is cohesive from the perspective of adaptive marine ecosystem and resource management because it includes fundamental characterizations and baseline surveys, coupled with assessments of fisheries, land-use activities, cumulative effects, and ecological variability. The summary also calls for the development of the infrastructure to integrate science, management activities, and policies toward a future that can support the conservation and sustained use of the U.S. marine and coastal resources.

Quality of Life

Context

Generally speaking, quality of life is a broad concept that covers the health and well-being of people. For the purposes of this analysis however, quality of life is considered to more specifically address lifestyle issues such as recreation, aesthetics, employment and tourism. (Health issues are covered under either Human Health or Ecosystem Health although they both undoubtedly affect our quality of life.) The JSOST vision for this theme is "a democratic society that maintains and improves the environmental health of the ocean and its coasts and, at the same time, facilitates access to and wise use of these areas by the many and varied people who live, work, and play within these ecosystems."

Brief Summary

The Task Team binned issues resulted in a much shorter list of quality of life issues than those defined by JSOST. It should be noted that several additional themes emerged from this binned list that didn't seem to fall under quality of life, but should be discussed. These issues include: valuation of ecosystem services, translation of scientific information to managers, information management including geographic information systems, natural resources management issues, land use, decision-making, mapping, communication, outreach, and monitoring. It should be noted that many of these listed issues are more tools than research issues. Aside from these issues, the quality of life issues that remained are very limited. It may well be that in the context of research priorities, most managers don't consider quality of life to be a research issue.

Common themes

No particularly strong themes emerged from the binned research needs. From the national reports the following three issues appeared relevant:

- Research is needed on the impacts of land use and population growth on coastal ecosystem function and condition.
- Research is needed that addresses the impact of marine debris on the aquatic environment and on the tracking of marine debris to its source.
- Research is needed on protected areas.

Geographic Differences

Only California, Alaska and the Northwest had regional priorities called out under the quality of life theme area. These are:

California

- Need for forecasting the impacts of population growth, demographic change, and urban development on coastal resources.
- Socioeconomic links between coastal communities and Pacific Rim commerce.

Alaska

- (Need research on) Change in access to subsistence resources altered distribution or abundance of subsistence resource and physical or perceptual barriers to subsistence uses.
- Impacts to local culture which may result from altered subsistence activities.
- Economic value of commercial, sport and subsistence fisheries and hunts.

Northwest

- Permit streamlining for major transportation projects.
- Enhance capacity of coastal industries to adapt to and prosper in the changing economic and regulatory environment of the Pacific NW.

Gaps in this Topic and Alignment with Resource Management Priorities

Due to the vague nature of this topic area and the lack of a JSOST summary for this issue, it is difficult to ascertain gaps. Some potential gaps are listed below.

Closing Commentary

This summary should be considered a work in progress. The JSOST summaries may shed some light on additional focus areas that should be addressed under the heading of Quality of Life. If resource managers were asked what their research priorities relating to quality of life are (along with a definition) we surely would get a more complete picture of needs. A few issues that appear to be missing are public access, the need for methodologies to factor in aesthetic values into resource management decisions, the impact of recreational activities (jet skiing, dock and piers, motor boats) on marine resources, and homeland security.

RECOMMENDATIONS AND NEXT STEPS

Recommendations

- This report of the Federal/State Task Team should be used as a starting point or "straw man" for engaging the coastal and ocean resource management community on their research priorities.
- Additional engagement of and feedback from the coastal and ocean resource management community, including the Great Lakes, should be part of the JSOST workshop on the Ocean Research Priorities Plan and additional outreach should be conducted for this constituency.
- Coastal and ocean managers should have an opportunity to add materials to the inventory of research priorities developed by the FSTT and further provide input on additional geographic differences in priorities.
- The FSTT should continue to be engaged in both the review of and communication on the JSOST Ocean Research Priorities Plan and Implementation Strategy.
- The FSTT feels strongly that both the Priorities Plan and Implementation Strategy should provide a clear statement on the science to management connection explaining how the results of new ocean science and technology development will be transmitted to and implemented by the resource management community.
- The Implementation Strategy should define a clear process for ongoing consultation and collaboration with coastal and ocean resource managers to ensure that research priorities are responsive to the changing needs of this community (at time scales on the order of months and years as opposed to decades).
- SIMOR should ensure that the results of the FSTT are kept alive and utilized as a reference for their work in integrated management of ocean resources.

Next Steps

- The Federal/State Task Team will use this report as a benchmark in examining the
 extent to which resource management concerns are reflected in the ongoing
 development of the JSOST Ocean Research Priorities Plan. The FSTT will
 review "Draft 0" of the JSOST Plan and cross-walk this report to that draft in
 developing comments.
- The FSTT will work with SIMOR and JSOST to make available the compilation of research priorities documents and resources (Appendix B) on the Council on Environmental Quality or other appropriate website.
- The FSTT will develop the following materials:
 - o A presentation for FSTT members and others to use at conferences, meetings and other forums to share the results of our work.

- o A one-pager to provide outreach at any sessions or meetings where there won't be time for an oral presentation.
- The FSTT will contribute to planning and engaging the audience for the JSOST workshop on the Ocean Research Priorities Plan and Implementation Strategy.

APPENDICES

- A. List of Federal-State Task Team Members
- B. Citation list of research priority documents

Appendix A: List of Federal-State Task Team Members

Co-Chairs

- Holly Greening, Senior Scientist, Tampa Bay Estuary Program
- Peyton Robertson, Deputy Director, NOAA Chesapeake Bay Office

States

- Brian Baird, Assistant Secretary for Resources, Resources Agency of CA
- Peg Bostwick, 404 Program Coordinator, MI Dept. of Environmental Quality
- Rick DeVoe, Executive Director, South Carolina Sea Grant Consortium
- Lisa Sharrard Jones, State Coordinator, Flood Mitigation Programs, SC DNR
- Denby Lloyd, Director, Alaska Division of Commercial Fisheries
- Bill Rohring, U.S. Virgin Islands Coastal Zone Management Program
- Steven Rumrill, South Slough National Estuarine Research Reserve, Oregon
- Susan Snow-Cotter, Massachusetts Coastal Zone Management Program

Federal Agencies

- Gary Brewer, U.S. Geological Survey, Eastern Region
- Phil Colarusso, EPA New England, Bob Howard, EPA Region 4 [alternate]
- Richard Corley, U.S. Department of Transportation, MARAD
- Paul DiGiacomo, NASA Jet Propulsion Laboratory
- Sheryl Kunickis, USDA/NRCS
- Bill Lang, Minerals Management Service
- Joan Pope, U.S. Army Corps of Engineers

Co-Chairs

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- Governing Board Member of the Estuarine Research Federation (ERF)
- Sits on the National Academy of Sciences (NAS) Ocean Studies Board
- Active member of the Association of National Estuary Programs

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- Chair of the Coastal States Organization (CSO) Science Work Group and former Chair of CSO (2002-2004)
- Commenced three-year initiative at CSO to ascertain state coastal managers' research and technology needs (Science to Management Initiative)
- Vice Chair, Ocean Research and Resources Advisory Panel
- Served on National Research Council Committee on Mitigating Shore Erosion Along Sheltered Coasts
- Member SC Sea Grant Consortium Program Advisory Committee
- Former Isle of Palms City Council member

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- Previous experience as watershed management official for local government in Virginia.
- With NOAA for the past 13 years, working on coastal management, nonpoint source pollution, monitoring needs, and policy.
- Deputy Director of the "NOAA Chesapeake Bay Office in Annapolis working to bring all of NOAA's capabilities to bear on the resource management challenges of Chesapeake Bay.

States

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- Vice Chair of the Coastal States Organization and Vice Chair of CSO Science Working Group
- Lead Staff to the Chair of the California Ocean Protection Council
- Chair, California Resources Agency Sea Grant Advisory Panel
- Member of the California Sea Grant Advisory Council
- Trustee on the California Ocean Science Trust
- Served with the National Academy of Sciences Ocean Studies Board Panel on Regional Marine Research Projects - Produced "Bridging the Boundaries of Regional Marine Research"
- Served on the National Sea Grant Panel to review the National Sea Grant Extension Program

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- For the past 16 years, has served as the Section 404 Program Coordinator in the Michigan Department of Environmental Quality (MDEQ) wetland program
- Vice Chair of the Association of State Wetland Managers (ASWM)
- Currently helping to organize August 2006 conference on Great Lakes Wetlands, sponsored by EPA, ASWM, and MDEQ

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- Vice Chair, National Federation of Regional Associations (NFRA-IOOS)
- Member, Board of Directors, SouthEast Atlantic Coastal Ocean Observing System (SEA-COOS)
- Program Manager, SouthEast Coastal Ocean Observations Regional Association (SECOORA)
- Member, External Linkages Advisory Committee, Oceans and Human Health Center, NOAA Hollings Marine Laboratory
- Chair, External Relations Committee, Sea Grant Association (SGA)
- Co-chair, Sea Grant Coastal Natural Hazards Theme Team, Sea Grant Association (SGA)
- Member, Executive Committee, Board on Oceans and Atmosphere (BOA), National Association of State Universities and Land Grant Colleges (NASULGC)
- Member, Advisory Committee, North Inlet-Winyah Bay National Estuarine Research Reserve

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- Past Chair of the Association of State Floodplain Managers
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- Directs management and research programs related to commercial fisheries throughout Alaska.
- Previous experience in biological oceanographic research, habitat protection and permitting, and natural resources policy and planning.
- Worked variously with state, federal, and local governments and the state university in Alaska for over 25 years.

Bill Rohring

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- Marine and estuarine ecologist with expertise in invertebrate zoology, life-histories, mariculture, and seagrass habitats
- Development of scientific research and monitoring programs within the National Estuarine Research Reserve System over the past 15 years
- Faculty appointments with the University of Oregon (Biology) and Oregon State University (Marine Resource Management)
- Works with local, state, tribal, and federal governments to apply science toward improved management of the Pacific northwest coastal zone

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- Susan has worked at Massachusetts CZM for ten years, first as Ocean Policy Coordinator and then as Assistant Director for Coastal and Ocean Management.
- Worked for six years on the Pacific Island of Saipan on coastal and fisheries management.
- She holds a Master of Marine Affairs from the University of Washington and a BA in Political Science from University of Massachusetts, Amherst.

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- Gary has been with the Department of Interior, U.S. Geological Survey since 1998 and presently serves as a senior member of the Regional Biologist's directorate. His responsibilities
- Serves as interdisciplinary liaison for program initiatives
- Serves on Management Committee for EPA's Gulf of Mexico Program.
- Represents USGS on the Federal Workgroup for the Gulf of Mexico Alliance.
- Member of Science Planning Committee for the 3rd International Deep Coral Conference.

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- Has worked in EPA marine regulatory programs for 17 years
- Conducted research in seagrass physiology for potential use as bioindicator
- Certified EPA Scientific Diver

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- Co-Chair, Ocean Theme of the Integrated Global Observing Strategy (IGOS)
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- Member, GEO User Interface Committee

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- MMS Regional Technical Representative on Advisory Committee on Acoustic Impacts on Marine Mammals
- Past DOI/MMS member on (Canadian) Georges Bank Review Panel
- Past DOI/MMS member on Bathymetric Subcommittee, Federal Geographic Data Committee
- Past DOI/MMS member on Subcommittee on U.S. Coastal Science

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Appendix B: Citation list of research priority documents

Q	Walanta (Carantalia)
Source National	Website (if available)
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